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職前科學教師學科教學知識發展之研究
The Development of Preservice Science Teachers' Pedagogical Content Knowledge

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中文摘要

本研究旨在探討國立彰化師範大學八十三學年度物理系三年級 23 位經由選修「科學教育」與「科學教育研究」這兩科目的學習，探究其對於科學教學本質的認知及對於教學知識的體驗。這一類的知識皆屬於職前教師學科教學知識的範疇。本研究的待管問題為；職前教師對於教學與教師的知識之認知與改變。

在研究過程中，「科學教育」的授課，大多根據科教研究的成果或文獻，並以講義提供職前教師課前閱讀，然後，在課堂中討論及講解。也曾以科學示範動、討論等，提供職前教師對於科學概念學習情境的理解。在學期初，每位職前教師皆需填寫「教學知識」，「教師知識」及「科學本質」等三種問卷。期末並與每位職前教師進行大約 20 分鐘的晤談。「科學教育研究」的授課，則以職前教師親赴國中試教為主軸，藉以探究其關於科學教學知識的實際表現。試教之前，先以四種錄影帶介紹教學的內涵，包括；合作學習的教學、教室觀察要領、大四職前教師及實習教師的實地教學。再將 23 位職前教師分為五組，進行試敦的準備與實施。每組皆先由一位職前教師在「科學教育研究」課中試教，再由同組的另一位職前教師赴國中試教一小時。期末，同樣再進行問卷填寫，以及與各組大約一小時的晤談。

本研究的主要資料，包括 23 位職前教師完成的問卷，學習歷程檔案，晤談及職前教師對於試教的準備過程與試教的實際表現。為提高研究的效度，逐一完成前述各項資料的分析，並依據三角交叉法，交互審核職前教師在不同學習情境中對於教學的認知、表現與反省，藉此確認這些職前教師學科教學知識之改變及成長之風貌。

大部分的職前教師對於教學的認知尚屬於理論式的認知，少數的職前教師能達到實踐的程度。甚且，這些職前教師對於學生的關注、學習責任的歸屬與教師應具備的知識之認知，與國外研究文獻相較，顯現有趣的差異。此外，職前教師對於授課內容的認知與感受常深受傳統積習與文化的影響，對於與教學有關的知識之獲得仍習於被動接受，缺少主動的追求。職前教師雖能認真於試教，但是，其學科教學知識仍明顯不足，尤其，多以“蒸餾或稀釋

的形式”，即簡化零碎的方式呈現科學概念。試教與教室觀察對於職前教師教學的認知與表現的影響最為顯著。應如何培養職前教師的學科教學知識應是師資培育不能忽視的課題。

關鍵字：師資培育;科學教學;學習情境;學習歷程檔案;反省思考

Abstract

The purpose of this study was to examine the effect of both a science education course and a science education seminar on the growth of preservice teachers' pedagogical content knowledge. Research question guided this investigation: What are preservice teachers' conceptions of instruction and subject matter and how do these conceptions change?

Twenty-three juniors from Department of Physics, National Changhua University of Education took the two aforementioned courses during the 1994 school year. These two courses were taught by the researcher. Qualitative research techniques were used to collect and analyze the data. Triangulation of multiple data sources were used to validate the results.

Several particularly interesting results were found. Most of the preservice teachers possessed Aristotelian conceptions of teaching. Very few of the presser-vice teachers could actually put their theories into practice. Further, 20 of the 23 preservice teachers thought that teachers should be responsible for students' achievement, while similar findings are rarely noted in western societies. Most preservice teachers encountered much difficulty in completing their questionnaires and writing up the final assignment. These tasks required a lot of effort. The preservice teachers typically presented their subject matter knowledge in a simplistic and disconnected way. This naturally caused junior high students to lose interest in learning. However, the experience of classroom observation and actual teaching had the most significant impact on the preservice teachers' conception of teaching science. Field observations of science teaching were helpful in providing preservice teachers opportunities to reflect upon their conceptions of both science teaching and science. It is also believed that this experience enhanced teachers' pedagogical content knowledge.

Key words：Teacher training; Science instruction; Learning context; Portfolios; Reflective thinking